

Appl. No. 10/010,858  
 Response to Restriction/Election dated August 11, 2004  
 Reply to Office Action of June 24, 2004

### Amendments to the Claims:

This listing of claims will replace all prior versions, and listing, of claims in the application:

### Listing of Claims:

- 1 1. (original) An electrode material comprising a surface/chemically modified  
 2 positive electrode (cathode) material, wherein the surface/chemical modification is a  
 3 ceramic.
- 1 2. (currently amended) The composition of claim 1, wherein the surface/chemical  
 2 modification is selected from the group consisting of  $\text{Li}_x\text{Ni}_{1-y}\text{M}_y\text{O}_2$ , where  $0 \leq x \leq 1$ ,  $0$   
 3  $\leq y \leq 1$ , and  $\text{M} = \text{Mg}, \text{Al}, \text{Ti}, \text{V}, \text{Cr}, \text{Fe}, \text{Co}, \text{Cu}, \text{Zn}$ , and  $\text{Ga}$ ;  ~~$\text{Al}_2\text{O}_3$ ;  $\text{Cr}_2\text{O}_3$ ;  $\text{MgO}$ ;  $\text{Al}_2$~~   
 4  ~~$\text{Mg}_2\text{O}_{3.5}$ , where  $0 \leq y \leq 2$ ;  $\text{Li}_{1-x}\text{Mn}_{2-x-y}\text{M}_y\text{O}_4$ , where  $0 \leq x \leq 0.33$ ,  $0 \leq y \leq 2$  and  $\text{M} =$~~   
 5  ~~$\text{Mg}, \text{Al}, \text{Ti}, \text{V}, \text{Cr}, \text{Fe}, \text{Co}, \text{Ni}, \text{Cu}$  and  $\text{Zn}$ ;  $\text{Zr}_{1-y}\text{M}_y\text{O}_2$ , where  $0 \leq y \leq 1$  and  $\text{M} = \text{Mg},$~~   
 6  ~~$\text{Ca}, \text{Zr}_{1-y}\text{M}_y\text{O}_{2.5-y}$ , where  $0 \leq y \leq 1$  and  $\text{M} = \text{Sr}, \text{Y}$ ; and a combinations thereof.~~
- 1 3. (currently amended) The composition of claim 1, wherein the positive electrode  
 2 (cathode) material is selected from the group consisting of  $\text{LiCoO}_2$ ,  $\text{LiMn}_2\text{O}_4$ ,  $\text{LiNi}_{1-y}$   
 3  $\text{Co}_y\text{O}_2$ , where  $0 \leq y \leq 1$  and  $\text{LiMn}_{1-x}\text{M}_x\text{O}_2$ , where  $\text{M} = \text{Cr}$  and  $\text{Al}$  and  $0 \leq y \leq 1$ , and  
 4  $\text{Li}_{1-x}\text{Mn}_{2-x-y}\text{M}_y\text{O}_{4-2x-8y}$ , where  $0 \leq x \leq 0.33$ ,  $0 \leq y \leq 1$ ,  $0 \leq \delta \leq 0.5$ ,  $\text{M} = \text{Mg}, \text{Al}, \text{Ti}, \text{V},$   
 5  ~~$\text{Cr}, \text{Fe}, \text{Co}, \text{Ni}, \text{Cu}$  and  $\text{Zn}$ , and  $\text{X} = \text{F}$  and  $\text{S}$ .~~
- 1 4. (canceled)
- 1 5. (withdrawn) The composition of claim 1, wherein the positive electrode  
 2 (cathode) material is  $\text{LiCoO}_2$ .
- 1 6. (original) The composition of claim 1, wherein the surface/chemical  
 2 modification material is  $\text{Li}_x\text{Ni}_{1-y}\text{Co}_y\text{O}_2$ , where  $0 \leq x \leq 1$ ;  $0 \leq y \leq 1$ .

Appl. No. 10/010,858  
Response to Restriction/Election dated August 11, 2004  
Reply to Office Action of June 24, 2004

- 1 7. (withdrawn) The composition of claim 1, wherein the surface/chemical  
2 modification material is  $\text{Al}_2\text{O}_3$ .
- 1 8. (withdrawn) The composition of claim 1, wherein the surface/chemical  
2 modification material is  $\text{MgO}$ .
- 1 9. (withdrawn) The composition of claim 1, wherein the surface/chemical  
2 modification material is  $\text{MgAl}_2\text{O}_4$ .
- 1 10. (original) The composition of claim 1, wherein the surface/chemical  
2 modification material is  $\text{Li}_{1.05}\text{Mn}_{1.9}\text{Ni}_{0.05}\text{O}_4$ .
- 1 11. (withdrawn) The composition of claim 1, wherein the surface/chemical  
2 modification material is  $\text{Cr}_2\text{O}_3$ .
- 1 12. (currently amended) An electrode material comprising a  $\text{LiMn}_2\text{O}_4$  spinel oxide  
2 having been surface/chemically modified with a surface/chemical modification material  
3 ~~selected from the group consisting of  $\text{Li}_x\text{Ni}_{1-y}\text{Co}_y\text{O}_2$ , where  $0 \leq x \leq 1$ ;  $0 \leq y \leq 1$ ;  $\text{Al}_2\text{O}_3$ ;~~  
4  ~~$\text{Cr}_2\text{O}_3$ ;  $\text{MgO}$ ;  $\text{MgAl}_2\text{O}_4$ ; and a combination thereof.~~
- 1 13. (original) The composition of claim 11, wherein the surface/chemical  
2 modification material is  $\text{Li}_x\text{Ni}_{1-y}\text{Co}_y\text{O}_2$ , where  $0 \leq x \leq 1$ ;  $0 \leq y \leq 1$ .
- 1 14. (withdrawn) The composition of claim 11, wherein the surface/chemical  
2 modification material is  $\text{Al}_2\text{O}_3$ .
- 1 15. (withdrawn) The composition of claim 11, wherein the surface/chemical  
2 modification material is  $\text{MgO}$ .
- 1 16. (withdrawn) The composition of claim 11, wherein the surface/chemical  
2 modification material is  $\text{MgAl}_2\text{O}_4$ .

Appl. No. 10/010,858  
Response to Restriction/Election dated August 11, 2004  
Reply to Office Action of June 24, 2004

- 1 17. (withdrawn) The composition of claim 11, wherein the surface/chemical  
2 modification material is  $\text{Cr}_2\text{O}_3$ .
- 1 18. (original) An electrode material comprising a  $\text{LiCoO}_2$  layered oxide having  
2 been surface/chemically modified with a surface/chemical modification material  
3 ~~selected from the group consisting of  $\text{Al}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{MgAl}_2\text{O}_4$ ,  $\text{Li}_{1+x}\text{Mn}_{2-x-y}\text{M}_y\text{O}_4$~~   
4 where  $0 \leq x \leq 0.33$ ,  $0 \leq y \leq 2$  and  $\text{M} = \text{Ni}$  or  $\text{Co}$ ; ~~and a combinations thereof.~~
- 1 19. (withdrawn) The composition of claim 17, wherein the surface modification  
2 material is  $\text{Al}_2\text{O}_3$ .
- 1 20. (original) The composition of claim 17, wherein the surface modification  
2 material is  $\text{Li}_{1.05}\text{Mn}_{1.9}\text{Ni}_{0.05}\text{O}_4$ .
- 1 21. (withdrawn) An electrode material preparation method comprising:  
2 supplying a  $\text{LiMn}_2\text{O}_4$  spinel oxide electrode material;  
3 mixing the  $\text{LiMn}_2\text{O}_4$  spinel oxide electrode material with a surface/chemical  
4 modification material selected from a group consisting of  $\text{Li}_x\text{Ni}_{1-y}\text{Co}_y\text{O}_2$ , where  $0 \leq x \leq$   
5  $1$ ;  $0 \leq y \leq 1$ ;  $\text{Al}_2\text{O}_3$ ;  $\text{Cr}_2\text{O}_3$ ;  $\text{MgO}$ ;  $\text{MgAl}_2\text{O}_4$ ; and combinations thereof; and  
6 heat-treating the mixture to prepare a surface/chemically modified  $\text{LiMn}_2\text{O}_4$   
7 electrode material.
- 1 22. (withdrawn) The method of claim 20, wherein the heat-treating is performed at  
2 a temperature in the approximate range of  $100^\circ\text{C}$  to  $1000^\circ\text{C}$ .
- 1 23. (withdrawn) The method of claim 20 wherein the heat-treating is performed for  
2 approximately 1 to 24 hours.
- 1 24. (withdrawn) The method of claim 20, wherein the surface/chemical  
2 modification material is in the approximate range of 1 to 20 weight percent of the  
3 surface/chemically modified  $\text{LiMn}_2\text{O}_4$  electrode material.

Appl. No. 10/010,858  
Response to Restriction/Election dated August 11, 2004  
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1 25. (currently amended) An electrode material comprising a surface/chemically  
2 modified  $\text{LiMn}_2\text{O}_4$  spinel oxide said electrode material prepared by a process  
3 comprising:

4 a) refluxion of a precursor solution in glacial acetic acid, wherein the precursor  
5 is selected from a group consisting of  $\text{Li}_x\text{CoO}_2$ ,  $\text{LiCo}_{0.5}\text{Ni}_{0.5}\text{O}_2$ , and  $\text{Al}_2\text{O}_3$ ;

6 b) preparing a precursor solution in water, wherein the precursor is selected  
7 from a group consisting of  $\text{Al}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{MgO}$ , and  $\text{MgAl}_2\text{O}_4$ ;

8 c) dispersing  $\text{LiMn}_2\text{O}_4$  spinel oxide in the precursor solution; and

9 d) heating the dispersed  $\text{LiMn}_2\text{O}_4$  spinel oxide to approximately 100 to 500  
10 degrees C; and

11 e) firing the heated dispersed  $\text{LiMn}_2\text{O}_4$  spinel oxide at 500 to 900 degrees C.

1 26. (withdrawn) A method of preparing an electrode material for lithium-ion  
2 batteries comprising:

3 supplying a  $\text{LiCoO}_2$  layered oxide electrode material;

4 mixing the  $\text{LiCoO}_2$  layered oxide electrode material with a surface/chemical  
5 modification material selected from a group consisting of  $\text{Al}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{MgO}$ ,  
6  $\text{MgAl}_2\text{O}_4$ ,  $\text{Li}_{1+x}\text{Mn}_{2-x-y}\text{M}_y\text{O}_4$  where  $0 \leq x \leq 0.33$ ,  $0 \leq y \leq 2$  and  $\text{M} = \text{Ni}$  or  $\text{Co}$ ; and  
7 combinations thereof; and

8 heat-treating the mixture to prepare a surface/chemically modified  $\text{LiCoO}_2$   
9 electrode material.

1 27. (withdrawn) The method of claim 23, wherein the heat-treating is performed at  
2 a temperature in the approximate range of  $100^\circ\text{C}$  to  $1000^\circ\text{C}$ .

1 28. (withdrawn) The method of claim 23 wherein the heat-treating is performed for  
2 approximately 1 to 24 hours.

1 29. (withdrawn) The method of claim 25, wherein the surface/chemical  
2 modification material is in the approximate range of 1 to 20 weight percent of the  
3 surface/chemically modified  $\text{LiCoO}_2$  electrode material.

Appl. No. 10/010,858  
Response to Restriction/Election dated August 11, 2004  
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- 1 30. (currently amended) An electrode material comprising a surface/chemically  
2 modified  $\text{LiCoO}_2$  layered oxide said electrode material prepared by a process comprising:  
3 a) refluxion of a precursor solution in glacial acetic acid, wherein the precursor is  
4 ~~selected from a group consisting of  $\text{Al}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{MgO}$ ,  $\text{MgAl}_2\text{O}_4$ ,  $\text{Li}_{1+x}\text{Mn}_{2-x-y}\text{M}_y\text{O}_4$~~   
5 where  $0 \leq x \leq 0.33$ ,  $0 \leq y \leq 2$  and  $\text{M} = \text{Ni}$  or  $\text{Co}$ ;  
6 b) preparing a precursor solution in water, wherein the precursor is selected from  
7 a group consisting of  $\text{Al}_2\text{O}_3$ ,  $\text{Cr}_2\text{O}_3$ ,  $\text{MgO}$ , and  $\text{MgAl}_2\text{O}_4$ ;  
8 c) dispersing  $\text{LiCoO}_2$  layered oxide in the precursor solution; and  
9 d) heating the dispersed  $\text{LiCoO}_2$  layered oxide to approximately 100 to 500  
10 degrees C; and  
11 e) firing the heated dispersed  $\text{LiCoO}_2$  layered oxide at 500-900 degrees C.